

Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

ASB763
A115N38

IND



United States
Department of
Agriculture

Forest Service

Northeastern Forest
Experiment Station

Northeastern Area

NA-TP-07-95

Shifts in Stocking Reveal Forest Health Problems //



Received by JLB

6 Indexing Branch

The United States Department of Agriculture (USDA) Forest Service is a diverse organization committed to equal opportunity in employment and program delivery. USDA prohibits discrimination on the basis of race, color, national origin, sex, religion, age, disability, political affiliation and familial status. Persons believing they have been discriminated against should contact the Secretary, U.S. Department of Agriculture, Washington, DC 20250, or call 202-720-7327 (voice), or 202-720-1127 (TTY).

Shifts in Stocking Reveal Forest Health Problems

Prepared by:



FIA, FHP, FHM, Forest Service,
Northeastern Area
Northeastern Forest Experiment Station
5 Radnor Corporate Center
100 Matsonford Road, Suite 200
Radnor, PA 19087

For more information call Forest Inventory and Analysis at
(610) 975-4075.

Shifts in Stocking Reveal Forest Health Problems

The health of our Nation's forests has become a major issue. Unfortunately, the term "forest health" is vague. It means many things to many people. Baseline standards for conducting a physical examination of a stand of trees do not exist. The Northeastern Forest Experiment Station's Forest Health Monitoring Program and other organizations are working on how to assess the dimensions of forest ecosystem health and how to analyze and report health trends.



However, one factor that can be considered when making judgments about the health of a particular forest tree species is change in the relative stocking of that species, that is, the extent to which that species is gaining or losing ground in its ecosystem. This we can measure with the help of forest inventory plot records.

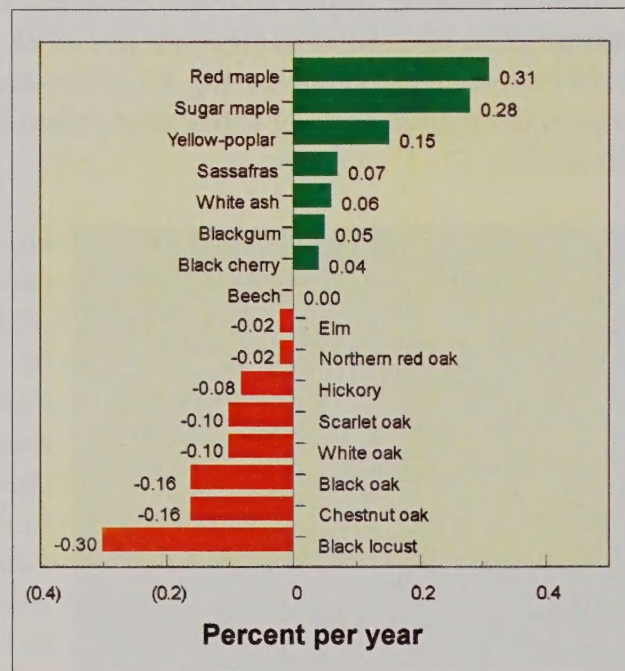
Estimating Change in Relative Stocking

Stocking is a measure of the extent to which trees utilize a plot of forest land. Formulae for calculating stocking levels have been developed for individual species. These stocking equations can be used with forest inventory plot data to estimate the average annual change in relative stocking for any tree species. We applied the procedure to Kentucky, Maryland, Ohio, Pennsylvania and West Virginia where a network of approximately 6000 permanent inventory plots were remeasured in recent inventories. Highlights are presented here.

Maples and Yellow-Poplar Gain While Black Locust and Oaks Lose Ground

Red maple is a pioneer species—a shade tolerant, prolific seeder and sprouter that can occupy a wide variety of forest sites. So, it is no wonder that red maple has recorded substantial gains in relative stocking throughout the five-state area. Overall, the annual gain in relative stocking of red maple averaged 0.31 percent between inventories.

Change in Relative Stocking KY, MD, OH, PA and WV



There has been much recent ado over the demise of sugar maple. Not too many years ago an article in the New York Times suggested that sugar maple was becoming extinct because of damage from acid rain. Such news prompted establishment of the North American Maple Project and the installation of plots to measure annual trends in the condition of this valuable hardwood species. It is too soon to draw conclusions from that study. But, our analysis indicates that, on the whole, sugar maple is doing quite well. In terms of gaining ground, it ranks right behind red maple. Substantial increases in the relative stocking of sugar maple were recorded in all five states.

Another prevalent species that made significant regional gains in relative stocking was yellow-poplar. White pine also performed well in states where it is common.

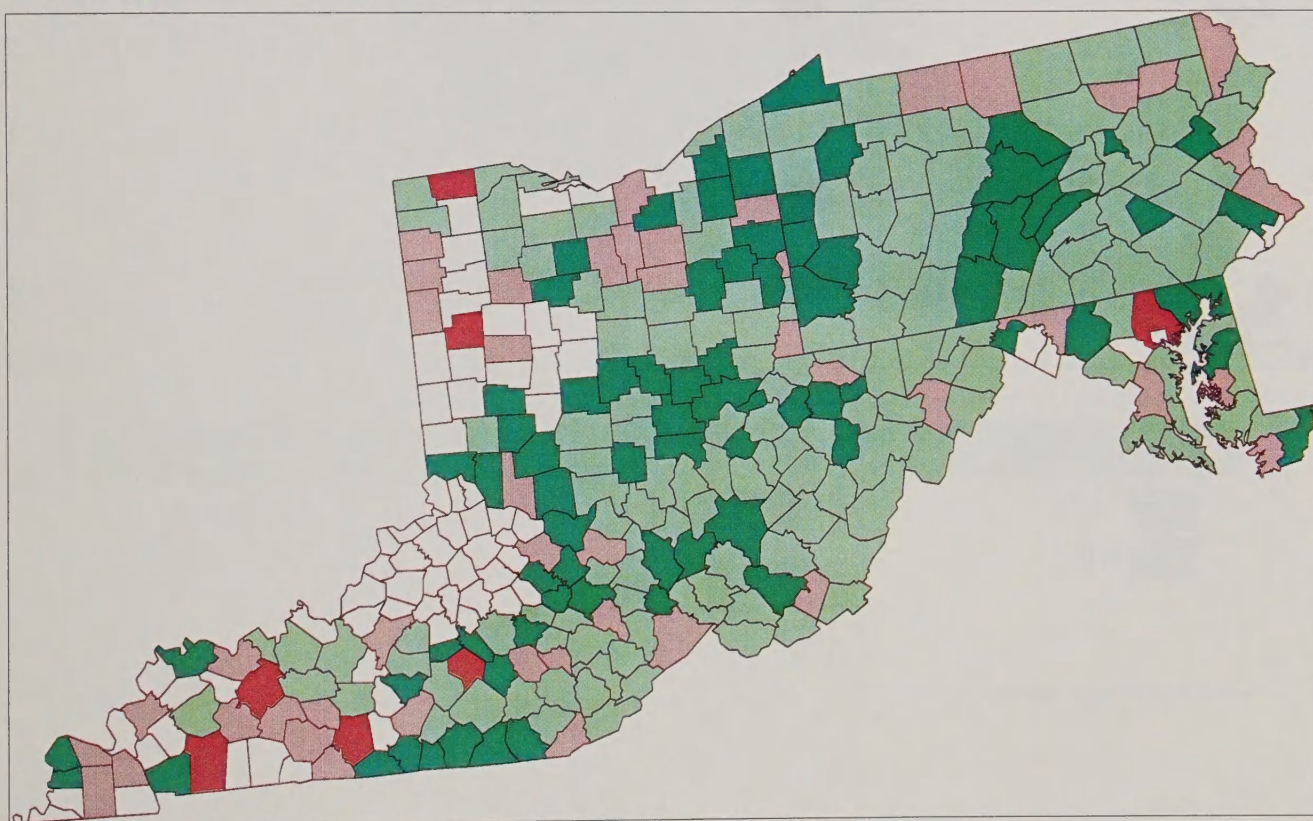
At the opposite end of the scale were black locust and the oaks (particularly chestnut, black, white, and scarlet oak). Black locust lost ground at a rate of 0.30 percent per year across the region. And why not? Forest land in this area has undergone healthy increases in average tree size and density in recent years. Black locust is sensitive to competition and intolerant of shade. Under stress, it falls easy prey to locust borers, leaf miners, heart rot, and other insects and diseases.

Much of the oak decline can be associated with gypsy moth. But oaks are also losing ground in areas where the pest is not yet a problem. Sharp declines in the relative stocking of hard pines are noteworthy. Virginia pine in Maryland, Ohio, and West Virginia; pitch pine in West Virginia and Kentucky; and shortleaf pine in Kentucky are all losing ground at noticeable rates.

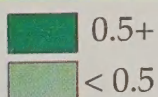
Tracking Trends and Spotting Problems

Since each inventory plot represents a proportional share of the forest area in a county, appropriate weights can be assigned to plot data to derive average trends in relative stocking for individual species in each county. County averages can then be mapped to provide a closer look at where a species is gaining or losing ground. Maps showing county trends for two of the area's top gainers (red maple and sugar maple) and two of its losers (black locust and chestnut oak) are presented here.

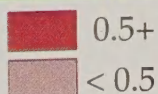
Red Maple




Gain (% per year)



Loss (% per year)

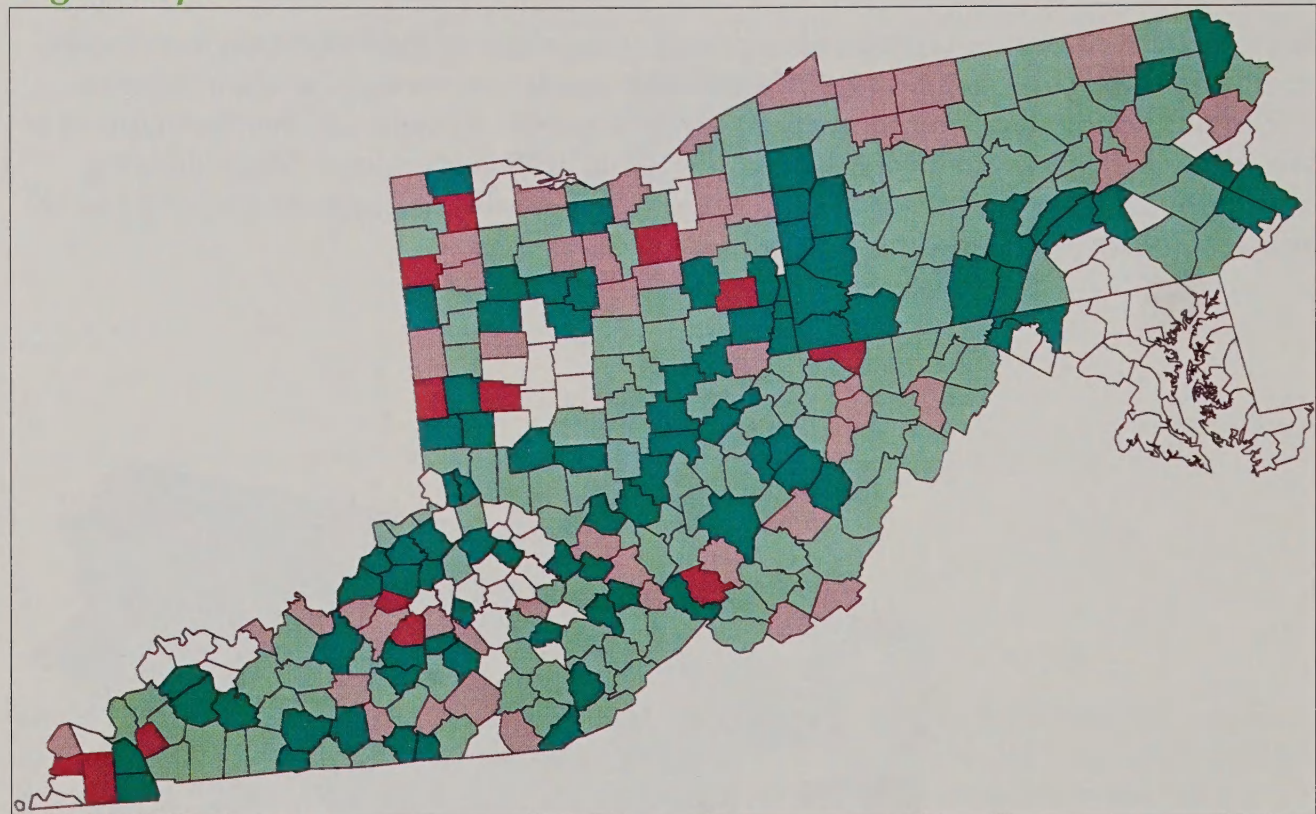


No information

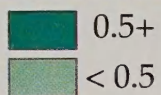
 Not tallied

Regional average = 0.31

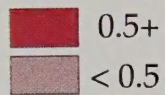
Sugar Maple



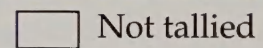
Gain (% per year)



Loss (% per year)

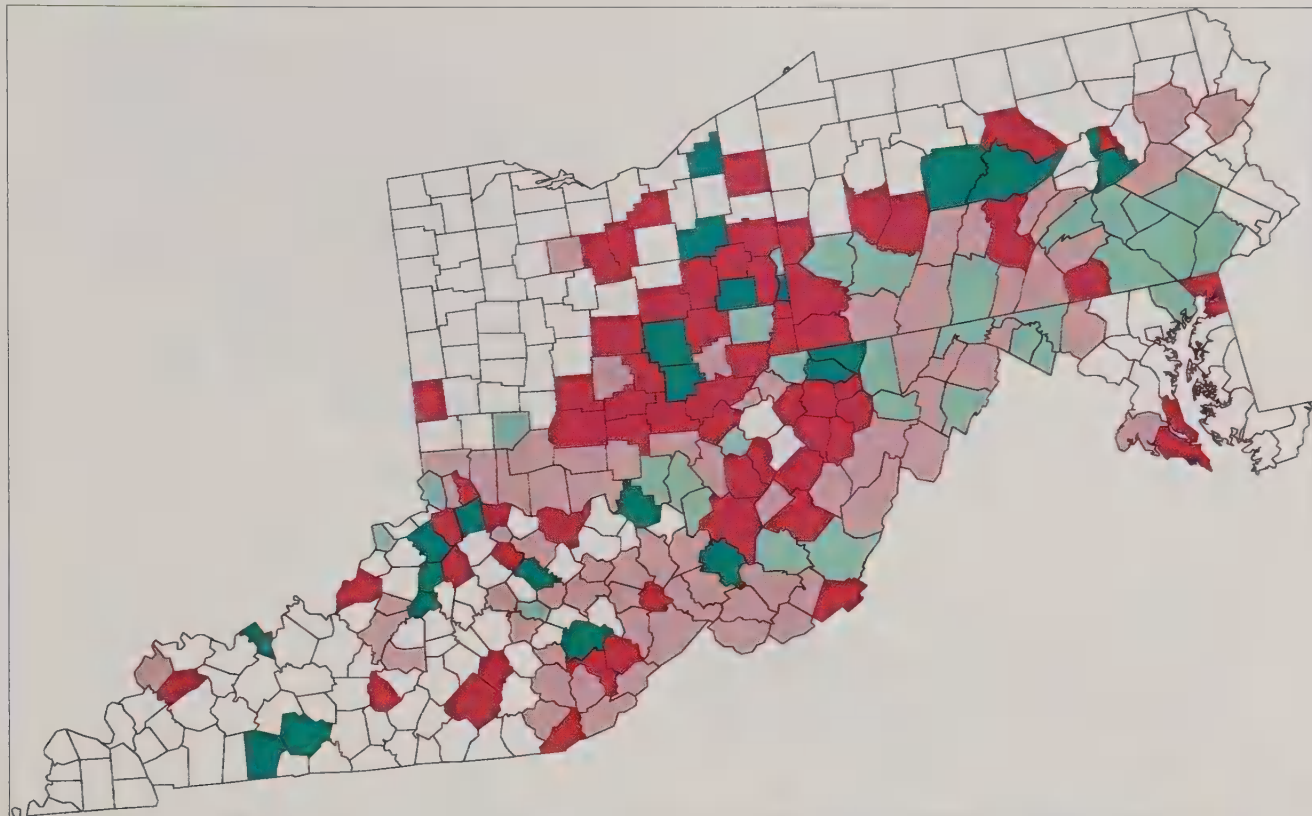


No information



Regional average = 0.28

Black Locust



Gain (% per year)

0.5+

< 0.5

Loss (% per year)

0.5+

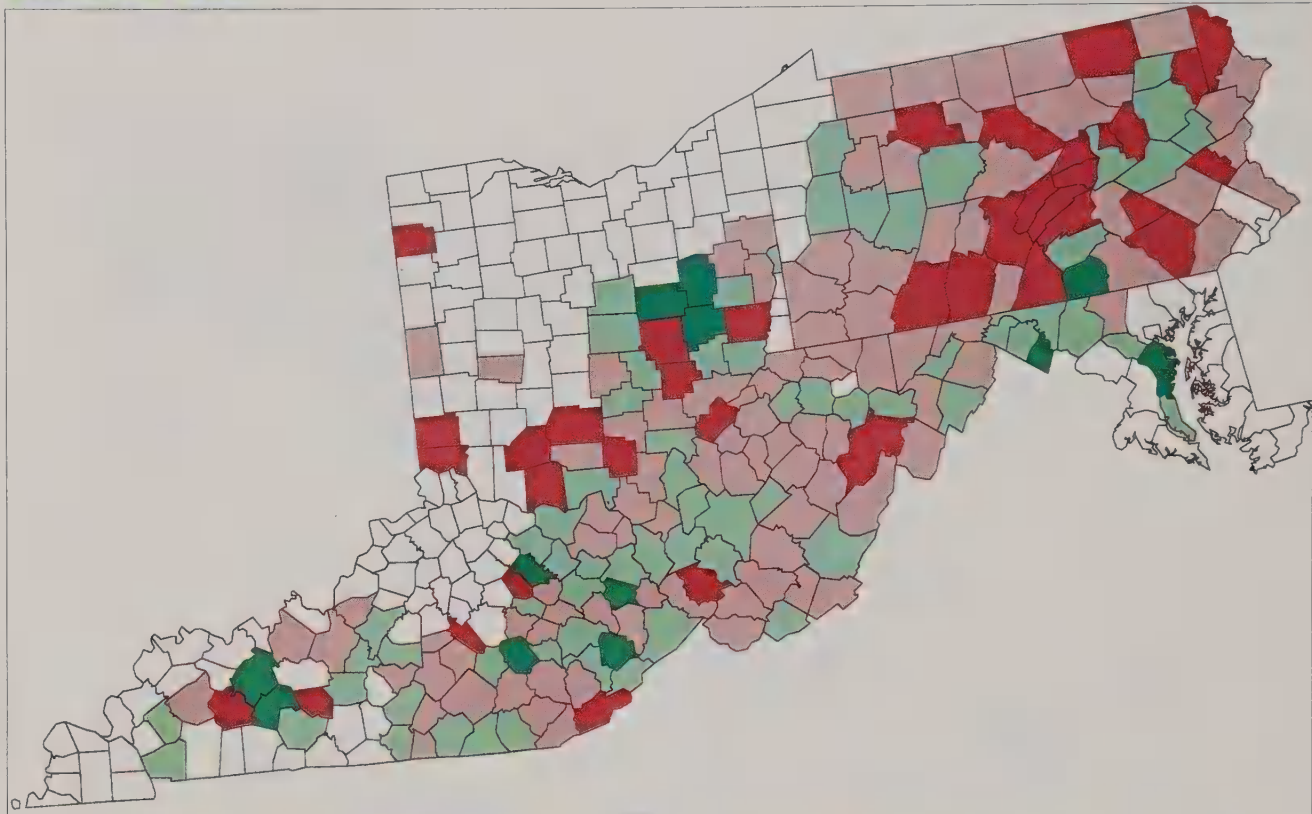
< 0.5

No information

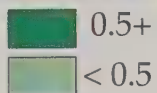
Not tallied

Regional average = -0.30

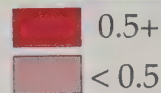
Chestnut Oak



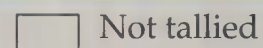
Gain (% per year)



Loss (% per year)



No information

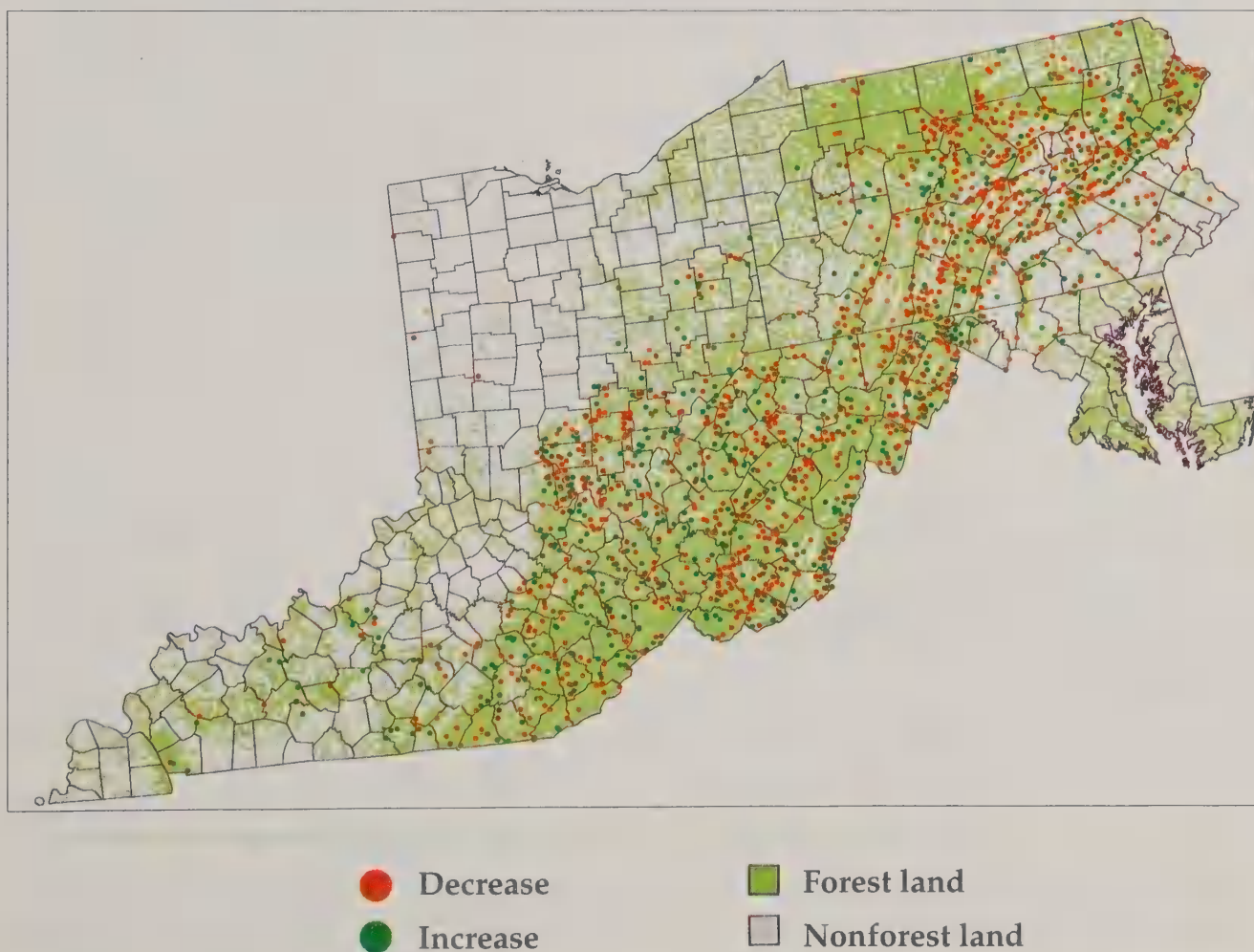


Regional average = -0.16

Using county averages to gauge trends in relative stocking has its limitations. Some county averages, especially those for sparsely forested counties, are based on very few ground plots and may be subject to high sampling errors. Locations of individual ground plots have been digitized, so trends for each plot also can be mapped. These maps provide a more specific view of spatial shifts in relative stocking. Together, maps showing trends for counties and individual plots can be used to detect areas where species are gaining or losing ground and, thus, help us locate potential problems in tree health.

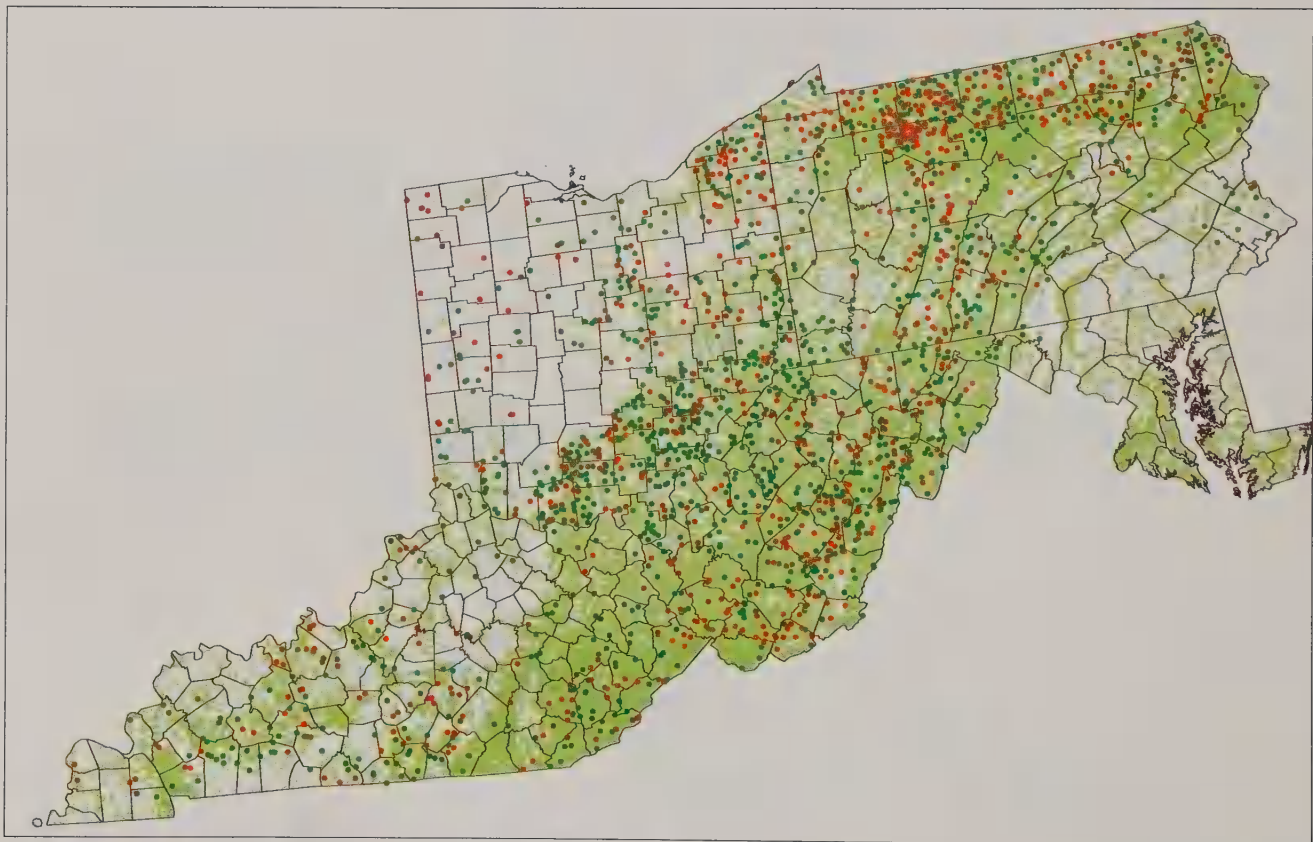
Change in Relative Stocking of Chestnut Oak on Plots

For example, chestnut oak has been losing ground in several of the region's counties. Declines were especially noticeable in Pennsylvania where chestnut oak occurred on one-third of the remeasured plots and was losing ground on two-thirds of them. Bedford County in south-central Pennsylvania epitomizes a worst case scenario. Here, change in the relative stocking of chestnut oak averaged -0.86 percent per year. Dead trees and stumps recorded on Bedford County plots provide clear evidence of why. For a first-hand view of the situation, take a ride on the Pennsylvania turnpike and check out the landscape around Everett, Pennsylvania. Some good news here is that most of the oak stands that were devastated by gypsy moth, drought, cutting, and other agents during the 1980's have regenerated to a more diverse mix of species such as maple, birch, cherry, ash, and yellow-poplar that are less susceptible to the gypsy moth.



Change in Relative Stocking of Sugar Maple on Plots

For a completely different scenario, take a look at sugar maple. Our maps indicate that this species recorded large gains in relative stocking in all five states. But the maps also show that while sugar maple was performing well regionwide, it was losing ground in some places such as the Allegheny Plateau in Elk, Forest, McKean and Warren Counties, Pennsylvania. Annual change in the relative stocking of sugar maple in these four counties averaged -0.12.



● Decrease

● Increase

■ Forest land

■ Nonforest land



Implications

The procedure used here to track shifts in relative stocking can be used for virtually any species anywhere. Results provide an extensive look at where each species is gaining or losing ground and, thus, a means for locating current and potential problems in tree health.

Findings of our analysis raise more questions than they answer. Will red maple continue its rapid gains in relative stocking and, if so, how will that affect the integrity of the region's forest ecosystem? Will oaks continue to lose ground or will they overcome the effects of gypsy moth and other stress that hit them hard during the last couple of decades? Why is sugar maple making significant gains regionwide but losing ground on the Allegheny Plateau of Pennsylvania—is it pear thrips, drought, overstocking, a combination of these factors, or none of the above? Many are hypothesizing that sugar maple just does not do well in dense maturing stands. Will black locust continue to disappear from the scene as overall stocking continues to improve? Is white pine on the verge of regaining the status it once held? What is happening to the hard pines? And what about hickory, especially in Kentucky, Ohio and West Virginia?

Information on shifts in relative stocking provides a symptomatic guide to recognizing problems of forest health. It also gives us a better understanding of the complex workings of a dynamic ecosystem. This information can help us make better decisions about the management and use of our precious forest resource.

